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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/893,035	06/27/2001	Hag-ju Cho	5649-874	3421

20792 7590 02/24/2004  
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EXAMINER

KIELIN, ERIK J

ART UNIT PAPER NUMBER

2813

DATE MAILED: 02/24/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No.	Applicant(s)	
	09/893,035	CHO, HAG-JU	
	Examiner	Art Unit	
	Erik Kielin	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 15 December 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1 and 3-13 is/are pending in the application.
- 4a) Of the above claim(s) none is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 and 3-13 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### DETAILED ACTION

This action responds to the RCE filed 15 December 2003.

#### *Claim Rejections - 35 USC § 112*

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1 and 3-13 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

As presently written, independent claim 1 is unclear as to scope for the following reason. It is unclear whether the newly added limitation of “substantially only” used to describe the extent of formation of the first metal oxide layer is directed to (1) only the portion of the insulation layer exposed by the upper and lower conductive layers, while **not** substantially forming the first metal oxide layer on the upper and lower conductive layers; or (2) only the portion of the insulation layer exposed by the upper and lower conductive layers “without forming the first metal oxide on the second surface portion [i.e. the unexposed portion] of the insulation layer,” without regard to the extent of coverage of the upper and lower electrodes.

The claim may be made clearly indicated the extent of coverage of the upper and lower conductive layers.

The remaining claims 3-13 are rejected for depending from rejected claim 1.

For the purposes of patentability, the claims will be given the broadest reasonable interpretation.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1, 3-6 and 9-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's submitted reference, **KR 2000-25706**, in view of US 6,203,613 B1 (**Gates et al.**).

Regarding claim 1, **KR 2000-25706** discloses the insulation layer **14**, upper **16** and lower **12** electrodes, wherein only the first surface portion (i.e. the exposed portion) of the insulating layer **14** exposed by the upper and lower electrodes is selectively covered with a first metal oxide **22** which serves as a reaction barrier layer to prevent damage to the insulating layer **14** during further processing. Note that selective forming of the first metal oxide does not exclude its formation on the electrodes. The second surface portion (i.e. the unexposed surface portion of the insulating layer in contact with the upper metal layer **16**) is not covered by metal oxide and does not overlap the second surface portion to any extent the term "overlap" is defined in the instant specification. (See Abstract and Fig. 4a. See instant Fig. 2.)

**KR 2000-25706** also discloses that the metal oxide ( $\text{Al}_2\text{O}_3$  or  $\text{TiO}_2$ ) may be formed by atomic layer deposition (p. 5, lines 22-24), but it is unclear --in the absence of a translation-- to determine if the method of ALD is explained, such as presently claimed in instant claims 1, 5, and 6.

**Gates** teaches a method of treating an oxygen-containing insulation layer with a metal precursor reactive with oxygen using ALD to form single or plural layers of metal oxide. (See

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cols. 7-10.) **Gates**, moreover, says that the ALD method is useful for fabricating gate and capacitor dielectrics and reaction barrier layers (col. 3, lines 20-25) such as the reaction barrier layer **22** in **KR 2000-25706**, used to protect the insulating layer **14** therein, as noted above.

**Gates** also teaches the specific method steps of ALD deposition including, pulsing metal precursor or diluted metal precursor and followed by exposure to inert carrier (cols. 7-10). Argon as the inert gas is taught at col. 7, line 14.

It would have been obvious for one of ordinary skill in the art, at the time of the invention to use ALD and the ALD conditions in **Gates** for forming the reaction barrier metal oxide layers in **KR 2000-25706**, because **Gates** teaches that the method is good for forming reaction barrier layers in integrated circuits, such as those in **KR 2000-25706**.

Regarding claims 3, 4, and 10, although the conditions of pulse time, flow rates and temperatures are not exactly as instantly claimed, each of these parameter ranges overlaps or is nearby those in **Gates** (cols. 7-10), amounting to a matter of routine optimization. (See MPEP 2144.05.) It would have been obvious for one of ordinary skill in the art, at the time of the invention to optimize the ALD conditions of the **Gates** method to form the reaction barrier layer (i.e. "the first metal oxide") of **KR 2000-25706**, to form the best reaction barrier layer, according to precedent.

Regarding claim 9, it is unclear if **KR 2000-25706** teaches the metal precursors for the ALD of the metal oxide. The claimed metal precursors are taught in **Gates** at least at col. 4, lines 56-64. It would have been obvious for one of ordinary skill in the art, at the time of the invention to use the metal precursors of **Gates**, as the metal precursors in **KR 2000-25706** because **Gates** also uses ALD to form aluminum oxide and teaches that the metal precursors are appropriate for

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aluminum oxide deposition. Moreover, it has been held that the selection of a known material based on its suitability for its intended use is *prima facie* obvious. (See MPEP 2144.07.)

Regarding claims 11 and 12, the insulation layer **14** of **KR 2000-25706** is a ferroelectric capacitor layer.

Regarding claim 13, the encapsulating oxide **18** is taught in **KR 2000-25706**. Also note, because the layers of the first oxide layer **22** in **KR 2000-25706** are built up layer-by-layer since ALD is used, each additional monolayer layer encapsulates the layer before it. Accordingly, the first metal oxide layer and the insulation layer are necessarily encapsulated by a second metal oxide layer, by virtue of the method by which ALD works, even if the encapsulating layer is not considered to be **18**.

5. Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over **KR 2000-25706** in view of **Gates** as applied to claims 1 and 2 above, and further in view of US 6,335,240 B1 (**Kim et al.**).

The prior art of **KR 2000-25706** in view of **Gates**, as explained above, discloses each of the claimed features except for thermally treating the integrated circuit device in oxygen.

**Kim** teaches annealing conditions for ALD deposited metal oxide films using O<sub>2</sub> at a temperature of 150-900 °C with exemplary embodiments at 450 °C, which falls within Applicant's claimed range of 400-600 °C. (See **Kim**, Abstract; col. 8, Table 3).

It would be obvious for one of ordinary skill in the art, at the time of the invention, to use the densification treatment of the metal oxide provided in **Kim** in the method of **KR 2000-25706**

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in view of **Gates** in order to densify the ALD layer and thereby to provide better reaction barrier layer protection.

Although the time is not as exactly claimed in claim 8, the choice would be a matter of routine optimization with a single variable. One would be motivated to find the time required to densify the thin film in **KR 2000-25706** in view of **Gates** for the specific purpose therein to provide protection to the insulating layer of the capacitor. (See MPEP 2144.05.)

### ***Response to Arguments***

6. Applicant's arguments filed 14 November 2003 have been fully considered but they are not persuasive.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., that the first metal oxide is not formed on the electrodes) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Further in this regard, the first metal oxide is shown in Fig. 2 to be formed on the upper and lower electrodes of the conductor.

Applicant argues that the first oxide layer of the **KR 2000-25706** patent overlaps the second surface portion. Examiner respectfully disagrees. Without commenting on the accuracy of Applicant's argument that overlap can occur between a first and third layer even in the presence of an intervening second layer, Examiner notes with interest that **Applicant's own Fig. 2 shows overlap between the first metal oxide 200 and the second surface portion (i.e**

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**unexposed surface) of the insulation layer 110.** Accordingly by making such argument, Applicant is arguing that the instant claims are **not enabled**, because there is no teaching how to prevent the overlap very clearly shown in Applicant's own Fig. 2.

### *Allowable Subject Matter*

Although not presently claimed in any claim, the instant claim 1 may be amended to overcome the present rejection by further indicating that, during the pulsing step, the metal precursor reacts with the insulation layer while only absorbing but not reacting with the upper and lower conductive layers, and that the absorbed metal precursor on the upper and lower electrodes is removed during the exposure to the inert gas. Support for this feature can be found on p. 7 of the instant specification --especially in the last paragraph. This feature would make clear the extent of coverage of the first metal oxide layer relative to the electrodes (i.e. the upper and lower conductive layers). Because instant Fig. 2 shows that the first metal oxide layer 200 contacts the upper and lower electrodes, the phrase "substantially only" is insufficient to describe the extent of coverage of the first metal oxide without creating an enablement problem.

### *Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 571-272-1693. The examiner can normally be reached on 9:00 - 19:30.



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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Erik Kielin

Primary Examiner

19 February 2004